PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference L0786-01160PWO2	**FOR FURTHER ACTION** See Form PCT/IPEA/416	
International application No. PCT/US05/05010	International filing date *(day/month/year)* 17 February 2005 (17.02.2005)	Priority date *(day/month/year)* 18 February 2004 (18.02.2004)
International Patent Classification (IPC) or national classification and IPC IPC(7): A63B 53/10 and US Cl.: 473/289, 473/319, 156/188, 264/635, 428/36.3, 428/36.9		
Applicant ALDILA, INC.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:

   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 9 sheets, as follows:

      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) _____ , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

Date of submission of the demand 16 September 2005 (16.09.2005)	Date of completion of this report 17 January 2006 (17.01.2006)
Name and mailing address of the IPEA/ US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Authorized officer Stephen L. Blau Telephone No. (571) 272-3700

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
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Box No. I Basis of the report

1. With regard to the **language**, this report is based on:
   - ☒ the international application in the language in which it was filed.
   - ☐ a translation of the international application into English, which is the language of a translation furnished for the purposes of:
     - ☐ international search (under Rules 12.3 and 23.1(b))
     - ☐ publication of the international application (under Rule 12.4(a))
     - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
   - ☐ the international application as originally filed/furnished
   - ☒ the description:
     pages 1-5 and 8 as originally filed/furnished
     pages* 6,7 and 9 received by this Authority on 16 September 2005 (16.09.2005)
     pages* NONE received by this Authority on
   - ☒ the claims:
     pages 15 and 16 as originally filed/furnished
     pages* NONE as amended (together with any statement) under Article 19
     pages* 10-14 received by this Authority on 16 September 2005 (16.09.2005)
     pages* NONE received by this Authority on
   - ☒ the drawings:
     pages 1/2-2/2 as originally filed/furnished
     pages* NONE received by this Authority on
     pages* NONE received by this Authority on
   - ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing (*specify*):
   - ☐ any table(s) related to the sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing (*specify*):
   - ☐ any table(s) related to the sequence listing (*specify*):

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-20	YES
	Claims NONE	NO
Inventive Step (IS)	Claims 1-11, 13, and 15-17	YES
	Claims 12, 14, and 18-20	NO
Industrial Applicability (IA)	Claims 1-20	YES
	Claims NONE	NO

2. Citations and Explanations (Rule 70.7)

Claims 12, 14, and 18-20 lack an inventive step under PCT Article 33(3) as being obvious over Takemura. Takemura discloses a shell of composite longitudinal fiber and resin material producing the same longitudinal bending/stiffness profile in each shaft of a family in the form of maintaining the number of plies the same between shafts for example 7 (Table 2), a core composite angle fiber and resin material with preselected weight being different from preselected weights in other shafts in a family to establish incremental differences in the weights of the shafts in the form of using different amounts of angled plies with is allowed in table 2 for example 7. The amount of plies can be 5 to 3. Clearly there is allowed to have the same incremental differences within the 5 to 3 plies allowed and it would be obvious to provide shafts of different weights to golfers who have different swing strengths.

Claims 1-11, 13 and 15-17 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the following. With respect to claims 1-11, 13 and 16-17, none of the prior art teaches or fairly suggest wrapping composite material around a different portion of a tapered mandrel to produce a family of shafts with the same longitudinal bending stiffness, wrapping a second preselected weight of composite angle fiber less than a first preselected weight, shafts with different weights and having the same outside surface between a first and second shaft. With respect to claims 15, none of the prior art teaches or fairly suggest a family of shafts with the same longitudinal bending stiffness, wrapping a preselected weight of composite angle fiber different between shafts, shafts having the same outside surface between a first shaft and a second shaft, and shafts having weights from 55 grams to 105 grams in 10 gram increments.

Claims 1-20 meet the criteria set out in PCT Article 33(4), and thus meets industrial applicability because the subject matter claimed can be made or used in industry. Shafts and method of making shafts are useful to produce golf clubs.

------------------- NEW CITATIONS -------------------

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Claims 1-20 are objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because claims 1-20 are indefinite for the following reason(s): In claim 1 (Lns. 23-24), claim 7 (Ln. 24), claim 10 (Lns. 15-16), claim 18 (Lns. 6-7) and claims 19-20 (Lns. 1-3) it states that the second core is the same size as the first core. In figure 6 the core (30) made by the angular fiber is different in size than the other cores (65,95,105). The cores are not the same size. In addition, the disclosure (Page 7, Lns. 19-21) states that the wrap will be moved up the taper profile to the left in figure 5 by a distance sufficient to adjust the O.D. of the lighter core to be substantially the same as the O.D. of the heavier core. This does not makes sense in that any movement to the left will not adjust the O.D. of the light core to be substantially same as a heavier core but different as shown in figure 6. As such claims 12-17 are also considered indefinite since in claim 12 (Lns. 10-12) it states that the core of each shaft having an outside surface that is maintained substantially the same size.

The drawings are objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 7 because: On page 7 lines 19-22 it states that the O.D. of the lighter core is substantially the same as the O.D. of the heavier core (30). Figure 6 does not show this. It shows that the O.D. of the lighter shell being substantially the same as the O.D. of the heavier shell (31).

opposite angled plies to be wrapped together in Step 2; three elongated trapezoidal sheets 25, 26 and 27 to be wrapped in Steps 3, 4 and 5; and one short triangular sheet to be wrapped around the tip portion in Step 6. Each representative sheet is shown as having a straight edge (the upper edges in Fig. 5) to be fixed on the mandrel at the beginning of the wrap, and angled opposite sides for spiraling around the mandrel during the wrap, the ends of the shaft being formed by end edges of the strips that are perpendicular to the longitudinal axis of the mandrel. The width of each sheet is sufficient to make a preselected number of layers around the mandrel 15, and the composition of each sheet is carefully selected to provide the types and weights of composite material that will produce the desired shaft 15.

It can be seen in Fig. 5 that angle-ply materials are applied in Steps 1 and 2 of the representative process to form a torsionally stiff inner core and (indicated generally at 30 in Figs. 2 and 3) reinforced end portions of the shaft and zero-ply materials are applied in Steps 3, 4 and 5 to form a longitudinally stiff outer shell indicated at 31 around the core 30. The specific amounts and types of materials are selected by the designer to produce the desired weight and bending profile of a particular shaft. Of course, the total amount of all materials in the shaft determines the weight of the shaft, while the zero-ply materials are primarily determinative of longitudinal stiffness, these being two of the most important characteristics in shaft design. Shaft designers have many approaches to the production of the most effective and desirable shafts, varying the amounts, types and placement of materials in efforts to achieve optimum results.

In accordance with the present invention, a family of golf club shafts is provided with greatly varying weights and having the same longitudinal stiffness/bending profile by using the same amount and types of zero-ply materials in each shift of the family, varying the amounts and weights of the angle-ply materials by a selected amount in each shaft to provide an incremental step from shaft to shaft in the family, and shifting the shaft along the taper

profile by an amount and in a direction that will compensate for the change in O.D. of the core 30 produced by the difference in the amount of angle-ply material used in the core, thereby maintaining the inside diameter ("I.D.") and, consequently the O.D., of the shell 31, to maintain its stiffness. This can be accomplished conveniently on the same mandrel 15 by moving the wrap a calculated distance along the taper profile (toward the larger end when the amount of core material has been decreased), or can be done on a different mandrel having the same taper profile.

While any desired increments of change of shaft weight may be produced with the present invention, a presently preferred family of shafts for the present invention uses substantially uniform increments of change of ten grains per shaft from a high end of 105 grams to a low end of 55 grams, it being understood that the range is discretionary with the shaft manufacturer and that the weight designations are nominal, and could go even lower and higher. The weights actually will vary within tolerances, typically as much as ± five grams or more, which can be affected by finish sanding, painting and other variations in the process in the finished shaft.

To illustrate the process, it can be assumed that the shaft 10 shown in the drawings and Fig. 5 is a "75 gram" shaft, and that the tip edges of the materials are positioned on the mandrel 15 a distance "χ" from the end of the taper profile. To produce a "65 gram" shaft 10, ten grams of weight will be removed from the angle-ply materials in Step 2 of Fig. 5 and the wrap will be moved up the taper profile, to the left in Fig. 5, by a distance "γ" sufficient to adjust the O.D. of the lighter core to be substantially the same as the O.D. of the heavier core 30. For example, depending upon the specific taper profile, "χ" may be calculated to be in the range of 2.0 to 3.0 inches, and "γ" may be in the range of 4.0 to 5.0 inches. Then the process is repeated with the other steps remaining the same. It is to be understood that, for heavier or lighter shafts in the family, the taper profile may be extended onto a different

the butt-end of the shaft moves up the taper profile by the same increments as the tip increments illustrated.

It should be noted that the representative finish wrap 28 on the tip will be moved up the profile to protect the tip end of the shell 31 from damage in the final grinding of the tip to the desired O.D. for mounting of a club head. The increase in the O.D. of the tip wrap in larger diameter (lighter) shafts will result in more material removal during grinding to the desired O.D., with resulting further reduction in total weight. It also will be understood that lighter shafts will have correspondingly reduced torsional stiffness.

Shown in Fig. 7 is a representative "Stiffness Profile" that shows the stiffness characteristics that may be achieved, and substantially uniformly maintained in a preferred family of shafts according to the present invention. Such a profile is measured by oscillating the shafts with various beam lengths and counting the number of cycles that occur over a specified period of time, referred to as the shafts frequency. Flex also can be measured through dynamic loading, or under static conditions in a laboratory. Different stiffness or flex families can be provided typically being designated as "L", "A", "R", "S" and "X", with "X" being the stiffest.

From the foregoing, it will be evident that the present invention provides a method for producing a family of shafts having essentially the same longitudinal bending stiffness and greatly varying weights, and provides the novel family of shafts as well. It also will be evident that, while a preferred mode and embodiment of the invention have been described in detail, various modifications and changes may be made by those skilled in the art without departing from the invention.

I claim as my invention:

1. The method of producing a family of elongated tubular golf club shafts of a predetermined length having the same longitudinal bending stiffness profiles and incremental differences in weights, including the steps of:

providing at least one elongated mandrel of circular cross-section longer than said predetermined length tapering along said taper profile from a larger butt-end portion to a smaller tip-end portion and sized to form the inside surfaces of a plurality of tubular shafts;

producing a first shaft in a first position on the mandrel relatively close to the tip end of the mandrel, by wrapping a first preselected weight of composite angle-fiber-and resin material around the mandrel to form a first core of angle-fiber-and-resin material for the first shaft, and wrapping a second preselected amount of composite longitudinal-fiber-and-resin material around the mandrel and said first core to form a first shell of longitudinal-fiber-and-resin material for said first shaft for determining the stiffness profile of the first shaft;

producing at least a second shaft on the mandrel having a different weight and the same longitudinal stiffness by wrapping a second preselected weight of composite angle-fiber-and-resin material less than said first preselected weight by a preselected increment of weight around a different portion of the mandrel spaced a predetermined distance farther from the tip end of the mandrel to form a second core of angle-fiber-and-resin material of said second preselected weight for the second shaft, and wrapping said second preselected amount of composite longitudinal-fiber-and- resin material around the mandrel and said first core to form a second shell of longitudinal- fiber-and-resin material for the second shaft for determining the stiffness profile of the second shaft, said predetermined distance being calculated to increase the outside surface of the second core to the same size as the first core, thereby to produce the same longitudinal stiffness profile for the second shaft.

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2. The method as defined in claim 1 including the further steps of producing additional shafts having cores of angle-fiber-and-resin composite materials of preselected incrementally lighter weights in spaced positions along said flex profile, and producing shells on said cores composed of longitudinal-fiber-and-resin composite material of said second preselected amounts and spaced along the taper profile predetermined distances calculated to maintain the outside surfaces of the cores at substantially the same outside size in each shaft, thereby to produce the same stiffness profile on each shaft and a weight that varies in accordance with the reduction in angle-fiber-and-resin materials.

3. The method as defined in claim 2 wherein the shafts are produced in nominal weights of approximately 55 grams, 65 grams, 75 grams, 85 grams, 95 grams and 105 grams.

4. The method as defined in claim 3 in which at least a second mandrel is used having a portion of substantially the same taper profile.

5. The method as defined in claim 1 wherein the steps of wrapping angle-fiber-and-resin materials to form the cores includes wrapping of at least two sheets of angle-fiber-and-resin material in each core, and the steps of wrapping longitudinal-fiber-and-resin materials to form the shells includes wrapping of at least two sheets of longitudinal-fiber-and-resin material in each shell.

6. The method as defined in claim 1 including the further steps of wrapping short sheets of angle-fiber-and-resin material around butt-end and tip-end portions of the mandrel as reinforcing wraps on both shafts.

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7. The method of producing a family of elongated tubular golf club shafts of a predetermined length having the same longitudinal bending stiffness profiles and incremental differences in weights, including the steps of:

providing at least one elongated mandrel of circular cross-section longer than said predetermined length tapering along said taper profile from a larger butt-end portion to a smaller tip-end portion and sized to form the inside surfaces of a plurality of tubular shafts;

producing a first shaft in a first position on the mandrel, by wrapping a first preselected weight of composite angle-fiber-and-resin material around the mandrel to form a first core of angle-fiber-and-resin material for the first shaft, and wrapping a second preselected amount of composite longitudinal-fiber-and-resin material around the mandrel and said first core to form a first shell of longitudinal-fiber-and-resin material for said first shaft for determining the stiffness profile of the first shaft;

producing at least a second shaft on the mandrel having a different weight and the same longitudinal stiffness by wrapping a second preselected weight of composite angle-fiber-and-resin material different from said first preselected weight by a preselected increment of weight around a different portion of the mandrel spaced a different predetermined distance from the tip end of the mandrel to form a second core of angle-fiber – and-resin material of said second preselected weight for the second shaftand wrapping said second preselected amount of composite longitudinal-fiber-and resin material around the mandrel and said first core to form a second shell of longitudinal-fiber-and-resin material for the second shaft for determining the stiffness profile of the second shaft, said predetermined distance being calculated to change the outside surface of the second core to the same size as the first core, thereby to produce the same longitudinal stiffness profile for the second shaft.

8. The method as defined in claim 7 wherein the first shaft is produced on said mandrel relatively close to the tip end of the shaft, and said second preselected weight is less than said first preselected weight, whereby the second shaft is wrapped around the mandrel a greater distance from said tip end to compensate for the reduced amount of angle-fiber-and-resin materials in the second core.

9. The method defined in claim 8 further including the additional steps of producing a third and successive additional shaft of the family having successively lighter cores beginning progressively farther up the taper profile to compensate for the reductions in the amount of angle-fiber-and-resin materials.

10. The method of producing a family of tubular golf club shafts having the same longitudinal stiffness profile and different weights, including the steps of:

producing a first shaft by forming a first preselected weight of composite angle-fiber –and-resin material about a first portion of a selected taper profile to form a first core, and forming a second preselected amount of composite longitudinal-fiber-and-resin material around the first core to form a first shell of the longitudinal-fiber-and-resin material for determining the stiffness profile of the first shaft;

producing at least a second shaft on a different portion of the same taper profile by forming a second, different preselected weight of composite angle-fiber material about said different portion of the same taper profile by forming a second, different preselected weight of composite angle-fiber material about said different portion of the taper profile to form a second core, and forming the same second preselected amount of composite longitudinal-fiber-and-resin material about said second core into a second shell, said different portion of the taper profile being spaced along the taper profile from said first portion to compensate for

the difference in the second preselected amount of core material and maintain the same outside size of the second core to produce the same stiffness profile from the second shell.

11. The method as defined in claim 10 including the further steps pf producing additional shafts having cores of angle-fiber-and-resin composite materials of preselected incrementally lighter weights in spaced positions along said flex profile, and producing shells on said cores composed of longitudinal-fiber-and-resin composite material of said second preselected amounts and spaced along the taper profile predetermined distances calculated to maintain the outside surfaces of the cores at substantially the same outside size in each shaft, thereby to produce the same stiffness profile on each shaft and a weight that varies in accordance with the reduction in angle-fiber-and-resin materials.

12. A family of tubular golf club shafts having the same longitudinal bending stiffness profiles and incremental differences in weights, each of said shafts comprising:

a shell of composite longitudinal-fiber-and-resin material having a preselected amount of longitudinal-fiber-and-resin material for producing said same longitudinal bending/stiffness profile in each shaft of the family;

and a core of composite angle-fiber-and-resin material for producing torsional stiffness in said shaft and having a preselected weight of the angle-fiber-and-resin, the preselected weight of angle-fiber-and-resin material in each shaft of said family being different from the preselected weights in the other shafts of the family to establish the incremental differences in the weights of the shafts;

the core of each shaft having an outside surface that is maintained substantially the same size to maintain the same size shell in each shaft.